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de Boer, J.; Botzen, W.J.W.; Terpstra, T.

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**Improving flood risk communication by focusing on prevention-focused motivation**

Joop de Boer<sup>\*1)</sup>, W. J. Wouter Botzen<sup>1)</sup>, Teun Terpstra<sup>2)</sup>

<sup>1)</sup> Institute for Environmental Studies, VU University Amsterdam

<sup>2)</sup> HKV Consultants, Lelystad

\* Address for correspondence:

Joop de Boer PhD

Institute for Environmental Studies

VU University Amsterdam

De Boelelaan 1087

1081 HV Amsterdam

The Netherlands

E-mail: joop.de.boer@vu.nl

Fax: +31 20 5989553

Phone: +31 20 5989555

## **ABSTRACT**

This paper proposes an approach to flood risk communication that gives particular emphasis to the distinction between prevention and promotion motivation. According to E. Tory Higgins (2012), the promotion system and the prevention system are assumed to coexist in every person, but one or the other may be temporarily or chronically more accessible. These insights have far-reaching implications for our understanding of people's reasoning about risks. Flood risk communication framed in terms of prevention involves the notions of chance and harm, woven into a story about particular events that necessitate decisions to be more careful about safety issues and protect one's family and oneself from danger. The paper describes how the insights worked out in practice, using a flood risk communication experiment among a sample from the general population in a highly populated river delta of the Netherlands. It had a posttest-only control group design ( $n = 2,302$ ). The results showed that risk communication had a large effect on the participants' responses and that this effect was higher among chronic prevention-focused people than among others. Any information that increased the fit between a prevention-framed message and a person's chronic prevention motivation produced stronger situationally induced, prevention-focused responses. This may significantly improve communication about risks. In contrast, the notion of water city projects, featuring waterside living, had more appeal to promotion-focused people.

Key words:

prevention, motivation, flood risk, communication

## Highlights

- Examines flood risk communication framed in terms of prevention.
- A communication experiment was conducted among a general population sample.
- Risk communication had a large effect on the participants' responses.
- This effect was higher among chronic prevention-focused people.

## 1. INTRODUCTION

Flood is the most common hazard in the world and flood risks will significantly increase due to the rising numbers of people living in river delta areas, coastal zones and river basins who are vulnerable to the impacts of climate change.<sup>(1)</sup> Yet, it is difficult to communicate with residents about these risks,<sup>(2-5)</sup> especially in places where the probability of flooding seems to be low,<sup>(6)</sup> or the issue of climate change has become controversial.<sup>(7)</sup> Although many studies have been done into flood risk perception and its influence on preparedness for these events, there is a strong need for theoretical and empirical studies on flood risk communication.<sup>(8,9)</sup> Following a seminal paper by Rogers (1975)<sup>(10)</sup> on the induction and subsequent reduction of fear, much of the existing work focuses on the combination of threat appraisal and coping appraisal, which forms the key to Rogers's Protection Motivation Theory (PMT).<sup>(11)</sup> Building on more recent insights from E. Tory Higgins's motivation theory,<sup>(12-14)</sup> however, the present paper proposes an approach to flood risk communication that goes beyond fear and protection to give particular emphasis to the potential role of prevention motivation. One of the main theoretical insights is that this type of motivation, such as a desire to be careful about safety issues, may significantly affect reasoning and judgment, including people's reasoning about flood risks. This process of "motivated reasoning"<sup>(15,16)</sup> may, for instance, take the form of pessimistic, negative thinking or optimistic, positive thinking. Importantly, motivated reasoning is shaped by both individual characteristics and the way the issue is framed. The present paper examines how these insights may improve flood risk communication and shows how this works out in practice, using a risk communication experiment that was carried out in the Rotterdam area of the Netherlands.

The study aimed to support policy makers in the region with relevant information about communicating with inhabitants on these issues, based on theoretical concepts and empirical data.

## **2. THEORETICAL BACKGROUND**

### **2.1 Protection motivation**

To avoid any misunderstandings, it should be emphasized that the conceptual difference between protection motivation and prevention motivation is much larger than the words protection and prevention may suggest. In terms of PMT, the construct of protection motivation is part of a causal model that was originally developed to explain the effects of fear appeals on behavior change, and afterwards elaborated into a decision model of alternative protective actions.<sup>(10,11)</sup> In this model, protection motivation is the intervening variable between, on the one hand, the person's assessment of threat and coping factors, and on the other hand, the person's goal intention to protect the self from danger. Other scholars, such as Lindell and Perry,<sup>(17,18)</sup> have added more perceptual variables, such as warnings and environmental cues, to the chain in what they call a Protective Action Decision Model (PADM) of the factors that influence individuals' adoption of protective actions. In addition to a protective response, the process may result in information search and emotion-focused coping to reduce fear. PMT and PADM have been recognized as useful models for explaining flood preparedness.<sup>(2,17-19)</sup> However, as Lindell and Perry (Ref. 18, p. 625) note, it is not entirely clear what motivates people to take protective action. Hence, the core mechanism of fear reduction may have to be complemented by other motivational processes.

## **2.2 Prevention and promotion motivation**

The construct of prevention motivation is part of a motivational framework that encompasses more than need satisfaction, because it also concerns the role of socialization and mental strategies. Higgins's Regulatory Focus Theory (RFT),<sup>(12-14)</sup> which agrees with the psychological literature on self-regulation,<sup>(20,21)</sup> specifies how goal directed behavior is regulated by two distinct motivational systems, termed promotion and prevention, which both are rooted in caretaker-child interactions.<sup>(12,22)</sup> What children learn about self-regulation varies when their interactions with caretakers focus on promotion or prevention. The promotion system is basically concerned with obtaining nurturance (e.g. nourishing food); it underlies a person's eager concerns with the pleasurable presence of positive outcomes, including accomplishments, aspirations and ideals. In contrast, the prevention system is concerned with obtaining security and avoiding negative outcomes (e.g. harm); it underlies vigilant concerns about safety and fulfillment of responsibilities. Among adults, the distinction between promotion and prevention has been observed in several contexts, including consumer behavior,<sup>(23,24)</sup> but with a few exceptions,<sup>(25)</sup> it has not been applied to environmental risk issues. Yet, this distinction may have far-reaching implications for our understanding of people's reasoning about flood risks.

The main implication is that it is not only relevant to know people's goal orientation (prevention or promotion) but also to understand their strategies to reach the goal (vigilant avoidance or eager approach). Higgins and colleagues have shown that the goal



of obtaining security fits very well with avoidance strategies, such as vigilant checking, to ensure safety and fulfillment of responsibilities or moral duties.<sup>(12-14)</sup> Such a fitting combination of goal orientation and strategies to reach the goal may give people the experience of “feeling right” about what they are doing. The avoidance strategy may also take the form of defensive pessimism, a form of negative thinking that allows a person to prepare for potentially dangerous situations by imagining the worst possible outcome and taking steps to avoid it. If the value of the prevention goal increases, people may pessimistically believe that they will not succeed in obtaining security unless they carry out some specific activities now. This is why they want to be careful about safety issues. Hence, for prevention oriented people, defensive pessimism might be a mobilizing factor, which shows the power of negative thinking to avoid the anticipated failure.

Alternatively, promotion oriented people may feel right about what they are doing if they use approach strategies (i.e. eagerly looking forward) to achieve accomplishments, aspirations and ideals. According to Higgins,<sup>(12-14)</sup> making a decision with a promotion orientation agrees with the literature on expectancy-value models of motivation; that is, it involves the motivation to maximize the multiplicative product of the value of goal attainment and the likelihood thereof. This model also agrees with the “protective action decision process” block in the PADM.<sup>(17,18)</sup> The important point here is that people with a promotion orientation will focus on positive outcomes and if the value of a promotion goal increases, they will show high levels of eagerness together with optimism and self-serving beliefs about the likelihood of goal attainment. This process may demonstrate the power of positive thinking to achieve maximum results. However, promotion-focused

people may also engage in too much wishful thinking and, at times, be overly optimistic and overeager. At such a moment, people who are in a promotion focus are less likely to act upon a persuasive message framed in terms of prevention.<sup>(26)</sup>

The far-reaching differences between promotion and prevention should not be understood as if there are just two types of people. Both the promotion system and the prevention system are assumed to coexist in every person, but one or the other may be temporarily or chronically more accessible.<sup>(13,27)</sup> That is, individuals may be chronically more prevention- or promotion-oriented. An individual's momentary focus on promotion or prevention will depend on his or her personal history along with circumstances induced by goal-relevant aspects of the situation. The latter may be framed in such a way that either promotion or prevention aspects are highlighted. An example is the choice between particular financial products, such as stocks and bonds. Because people tend to be most attentive to product information that is consistent with their predominant goal orientation, they may learn to prefer the option with the promotion benefit or the one with the prevention benefit and apply their choice strategy over and over again rather than reconsider it on every occasion.<sup>(27)</sup>

### **2.3 Relevance for risk communication**

Although RFT has not yet been used to investigate flood risk communication, it provides a number of insights that can be extremely useful to frame the information. Frames are mental knowledge structures that capture the typical features of a situation or event sequence, in order to secure the coherence of concepts and, therefore, of knowledge and

experience.<sup>(28,29)</sup> Framing flood risk communication in terms of prevention requires, what the linguists Fillmore and Atkins (1992) call, a risk frame.<sup>(30)</sup> A risk frame crucially involves the notions of chance and harm, but this is not enough because people can only understand what the risk is by considering the main events (e.g. failure of the dike) that are conceptually linked to the unwelcome outcome (e.g. a flood).<sup>(28)</sup> Here, the concept of prevention motivation can be of great help, because it may highlight concerns about safety and fulfillment of responsibilities. The notions of chance and harm can be woven into a story about particular events that may necessitate decisions to be more careful about safety issues and protect one's family and oneself from danger. Moreover, depending on the history of the people and the place, prevention motivation may have become associated with particular behaviors or situations (e.g. potential hotspots), which can be mentioned in the communication with all the details needed. The validity of the assumed process can be tested in an empirical manner by looking for a significant interaction between people's chronic motivational orientation and the way the risk is framed. This leads to the hypothesis that if people's reasoning about flood risk is influenced by prevention motivation, the risk frame is more likely to have an effect on prevention-focused people than on others. For instance, the former will consider more precautions than the latter. In addition it is relevant that a prevention-framed message does not fit with a promotion focus, which, for example, is concerned with the non-risk features of the situation.

Prevention and promotion may also play a role in how people reason about the issue of climate change and, more specifically, the issue of climate change and flood. Although

this topic has not yet been studied in a systematic manner, it is obvious that there are many examples of motivated reasoning where people make very pessimistic or very optimistic assumptions about climate change.<sup>(31,32)</sup> Although people experience climate change mainly from a spectator's point of view,<sup>(33)</sup> as something at a certain distance from themselves, they tend nowadays to become ideologically polarized in their beliefs about this issue.<sup>(34)</sup> Several studies suggest that climate change skeptics may respond very negatively to anything they see as pressure by the supporters of climate change prevention,<sup>(35)</sup> and that overly dire messages about climate change can backfire with some individuals.<sup>(7)</sup> Hence, this might also hamper flood risk communication as far as it relates to climate change.

## **2.4 The present study**

The present study aims to examine how the insights about prevention motivation work out in practice, using a flood risk communication experiment among a sample from the general population in the Rotterdam area of the Netherlands. The main part of this river delta near the North Sea coast is protected by a system of dikes and polders (polders are low-lying areas of land that have been reclaimed and are protected by dikes). The dikes are designed to withstand water levels that occur with frequencies of 1/10,000 per year or 1/4,000 per year. Along the river there are also city areas outside the dikes, such as redeveloped harbor areas, which are relatively safeguarded against flooding due to their high elevation above sea level. As a result of extreme weather events, however, the inhabitants of the region may have to cope with water nuisance and flood risks, which may increase with climate change. The study area was particularly suitable for the

communication experiment, because there had not been much communication on these risks. Moreover, the local authorities were looking for advice on communication issues in the context of plans to make the delta area more “climate proof”. As Kabat and colleagues note the idea of climate proofing is to use hard infrastructure to reduce flood risks to a quantified level, accepted by society, and to reduce this risk further by “softer” measures, such as insurance schemes or evacuation plans, which require adequate communication with residents.<sup>(36)</sup>

The experiment was a questionnaire study in which the participants were asked to respond to realistically framed descriptions of living conditions (i.e. experimental groups) or to their own living conditions (i.e. control group). To analyze the role of prevention motivation, it was necessary to focus the attention of the participants in the experimental groups on one out of a few risk frames, in which the notions of chance and harm were woven into stories, supported by pictures, about (1a) floor flooding outside the dikes or (1b) deep flooding in a deep polder. To make the risks appear more proximal and concrete, these groups of participants were asked to respond to the stories as if they themselves lived in a neighborhood either outside the dikes or in a deep polder. Outside the dikes, there was a 1 in 10 year probability of floor flooding. In the deep polder, there was a 1 in 2000 year probability of deep flooding. These two contrasting frames were crossed with a second factor, the communication strategy, which either (2a) highlighted the risks (e.g. including the uncertain effects of future climate change) or (2b) offered additional reassurance to the participants (e.g. the commitment of the authorities to provide flood safety). This resulted in four risk frames, which were all highly relevant to

the delta area. The control group was not given a story and was asked to respond to the questions based on their own situation. The research model was meant to analyze the effects of the risk frames on the experimental groups in comparison with the control group.

Focal point for the analysis is the distinction between, situationally induced, prevention-focused and promotion-focused responses to the frames. The participants' responses to the frames were supposed to reflect two forms of motivated reasoning, namely prevention focused defensive pessimism (e.g. "If I lived in a neighborhood outside the dikes, then I would keep in mind that I will have to deal with flood damage sooner or later") and promotion focused optimism (e.g. "If I lived in a neighborhood outside the dikes, then I would mainly look at all the amenities of the water"). In the experimental groups, these situationally induced responses were expected to be related to the participants' chronic prevention- or promotion-focused orientations.

It should be noted, however, that there are no standard tools to measure the chronic orientations in the general population, because almost all the work in the field of motivation theory is based on laboratory experiments with students as subjects and the student-based measures may be less appropriate for lower-educated or older participants.<sup>(37)</sup> A more suitable approach was derived from the work of Zhou and Pham<sup>(27)</sup> on how people learn to associate different products with prevention or promotion. In a highly similar way, we assume that people who live in a delta area learn to discriminate between living conditions with a prevention benefit (e.g. a flood insurance

policy) and those with a promotion benefit (e.g. a view of the water), and that they develop their own preferences for how they want to live. Drawing on several studies into the associations between motivational focus and preferences,<sup>(27,38-41)</sup> we expect that living conditions have a prevention benefit if they provide security, safety or stability to persons who tend to obey the rules, and that living conditions have a promotion benefit if they appeal to persons who are self-determined, achievement oriented, and open to change. In turn, the participants' preferences can be used to measure their chronic motivational orientation.

The research model is summarized in Figure 1. In comparison with the control group it is the interaction between risk frame and chronic motivational orientations that determines the situationally induced, prevention-focused and promotion-focused responses. More specifically, if the risk frame induces prevention-focused reasoning about flood risk, it is more likely to have an effect on participants who are chronically prevention-focused than on others. This is the main hypothesis of the paper.

## FIGURE 1

In addition to this theory-based model, two other issues were examined in view of the context of climate proofing. First, there is the issue of climate change itself. Although people experience climate change mainly from a spectator's point of view, they may be able to differentiate general beliefs about climate change from specific beliefs about climate change risks at the local level. The latter may be more relevant for flood risk

communication. To examine their relative impacts, both general and specific beliefs are included in the study.

The second issue is the role of promotion motivation in this study. Because insights on prevention motivation may be of primary importance for flood risk communication, this study gives relatively less attention to promotion motivation. However, the idea of climate proofing may include the design of “water city projects”, featuring waterside living outside the embanked areas. To explore whether the amenities of living near the water appeal to promotion-focused people, we decided to create an additional risk frame next to the others, which promotes waterside living (resulting in five risk frames).

### **3. METHOD**

#### **3.1 Design**

The experiment used a posttest-only control group design with two factors in a partial factorial arrangement (see Table I). The first factor was focus of the storyline (living outside the dikes or in a deep polder) and the second was communication strategy (highlight the risk, offer reassurance, promote waterside living).

TABLE I

#### **3.2 Subjects and procedure**

The very high degree of Internet penetration in the Netherlands (more than 90% of the population) enabled a survey among residents with Internet access. The sample was



drawn from a large panel of persons in the Rotterdam area who are willing to participate in web-based research for a small a reward, which they can keep for themselves or donate to charity. In June 2011, the questionnaires were completed by 2,302 participants (response rate 69%) in the age of 25 until 75, who are head of household, or who are the spouse/partner of the head of household, and therefore potentially responsible for the safety of themselves and any other members of their household. The data showed a representative distribution of the main demographic characteristics, although young males, low income renters, and people from ethnic minorities were slightly underrepresented in comparison with a prior survey.<sup>(42)</sup>

The participants had been randomly divided into 5 groups of about 400 (see Table I), each responding to a differently framed description, and a control group of 205. The questionnaire they received contained a short description to introduce its storyline and various modules with blocks of questions to measure the participants' responses to the frame, their monetary valuation of insurance against flood risk, their perceptions of flood hazard adjustments, their chronic prevention and promotion orientations, their beliefs about climate change, and socioeconomic variables (gender, age, level of education and income, homeownership, ethnic background). The modules were based on earlier work on insurance,<sup>(43)</sup> flood hazard adjustments,<sup>(44)</sup> prevention and promotion orientations,<sup>(23)</sup> and beliefs about climate change.<sup>(35)</sup> We had conducted a qualitative pretest and a pilot study to check whether the participants were able to understand the descriptions and the questions. In the present paper, we use from the various modules the questions on responses to the frames, on prevention and promotion motivation, and on climate change.

### **3.3 Experimental conditions**

Each experimental condition was based on a risk frame in which the notions of chance and harm were woven into a story about particular events (e.g. extreme weather) that are conceptually linked to an unwelcome outcome (e.g. a flood). It should be emphasized that all the presented information was carefully chosen to provide realistic representations and descriptions that the local authorities in the Netherlands could use for the purpose of flood risk communication.

Frames 1, 2 and 3 were stories about living in a neighborhood outside the dikes, such as a redeveloped harbor area, which are often elevated, but where floods can occur that potentially cause damage. All three frames used the same risk information but additional information varied. The risk information described “(...) the combined effect of large amounts of water in the rivers and a storm surge of seawater (during a Northwestern wind), which causes high water levels in the delta. This hazard has decreased because of the Maeslant (storm surge) Barrier, but has not been completely eliminated. During times of high water levels streets can be covered with water. Such high water levels occur on average once in 10 years.” The information below was specific to each frame.

Frame 1 highlighted the risks with four pictures of floor floods and a statement about the impacts of climate change, which may increase the flood risk outside the dikes in the future. Instead of highlighting the risks, Frame 2 provided reassurance; it included neutral pictures of neighborhoods outside the dikes and a statement about how the Dutch

government continuously works on flood safety and protection against the water in the far future (until the year 2100). Frame 3 included pictures of waterside living as well as statements about its increasing popularity and new ideas to make water city projects more attractive, partly with a view on climate change.

Frames 4 and 5 were stories about living in a deep polder near the river, which mentioned that it is increasingly common that such houses are built at a depth of 5 or 6 meters below the water level of a river. Both frames used the same risk information but additional information varied. The risk information described “(...) the combined effect of large amounts of water in the rivers and a storm surge of seawater (during a Northwestern wind), which causes high water levels in the delta. This hazard has decreased because of the Maeslant (storm surge) Barrier, but has not been completely eliminated. Dikes can breach if water levels in the river are very high. Such high water levels occur on average once in 2000 years. But, a dangerous situation can also arise if water levels are lower. That is because not all dikes are exactly equally strong. Even though the probability is low, the water level in the polder after a dike breach can rise up to 2 to 3 meters high.”

The information below was specific to each frame. Frame 4 highlighted the risks with four pictures of deep floods and a statement about the impacts of climate change, which may increase the flood risk in deep polders in the future. Frame 5 provided reassurance; it included pictures of hard infrastructure for flood protection and a statement about how the Dutch government continuously works on flood safety and protection against the water in the far future (until the year 2100).

### **3.4 Measures**

#### *3.4.1 Situationally induced prevention- and promotion-focused responses*

One block of questions asked for responses to the frames. These questions measured motivated reasoning in terms of prevention focused defensive pessimism (e.g. “If I lived in a neighborhood outside the dikes, then I would make sure that I am well prepared for high water levels”) and promotion focused optimism (e.g. “If I lived in a neighborhood outside the dikes, then I think that my house will be very attractive because of the water abundant environment”). All responses were invited on a 7-point scale, anchored by 1 (“does not apply to me at all”) to 7 (“applies to me completely”). The participants in the control group answered slightly differently worded questions (“As inhabitant of this river delta, I want to make sure that I am well prepared for high water levels”). Table II presents the various responses and Section 4 discusses the results.

#### *3.4.2 Chronic prevention and promotion orientations*

The participants’ chronic motivational orientation was measured by their ratings of short portraits. This method was adapted from Schwartz.<sup>(45)</sup> Each portrait consists of two sentences describing a person in terms of a value or preference that is important to him or her. We assumed that participants have a chronic prevention focus if they prefer security, safety, stability or obeying rules. They have a chronic promotion focus if they prefer portraits of persons who are self-determined, achievement oriented, and open to change. The female version of a prevention item is: “A safe environment is important for her; she

prefers to avoid everything that is risky.” The female version of a promotion item is: “She is able to handle setbacks very well; she remains optimistic about a positive outcome.”

The participants were asked to compare the portrait to themselves and to rate on a 7-point scale “how much like you” the person is. The short portraits are described in Table III.

#### *3.4.3 Skepticism about climate change and awareness of local climate impacts*

A set of six items measured general beliefs about climate change or specific beliefs about climate change risks at the local level. Responses were invited on a 7-point scale, ranging from completely disagree to completely agree. One of the items to assess general beliefs is “The seriousness of climate change has been exaggerated.” This item was taken from Eurobarometer surveys, which enable the European Union to monitor the evolution of the public opinion in its member states.<sup>(35,46)</sup> Two contrasting items on expected sea level rise due to climate change were either overly optimistic (“not more than 10 centimeters during the next 20 years”) or fairly realistic (“more than 10 centimeters during the next 20 years”) representations of IPCC figures.<sup>(47)</sup> Awareness of local climate impacts was measured by items such as “Due to climate change and flood risks, the value of the dwellings outside the dikes will decrease in the future.” The items are described in Table IV.

### **3.5 Statistical analysis**

The test of the hypothesized interaction between risk frames and chronic prevention orientation was prepared by means of principal component analyses to check the measures of prevention and promotion. Principal component analysis was also used to

examine general and specific beliefs about climate change. In this case, an oblique rotation (Promax) was chosen because the components might be related to each other. Using the regression method, component scores were calculated for each participant ( $M = 0$ ,  $SD = 1$ ), which were used for all subsequent analyses. The hypothesized interaction was tested by running a series of regression models. The experimental conditions were dummy coded to show the effects of the frames. The first dummy variable represents the difference between control and experimental groups (coded 0, 1); the other dummy variables (coded -1, 0, +1) represent additional differences between those who responded to the frames about living inside or outside the dikes, the frames that provided reassurance or highlighted the risk, and the frames that either or not promoted waterside housing. The interaction term was the product of experimental condition and chronic prevention motivation. The effect of the interaction was graphically illustrated in accordance with the procedure specified by Aiken and West.<sup>(48)</sup> To explore the generalizability of the results, we included the descriptive variables gender, age, and education. SPSS 20 was used for all calculations.

## **4. RESULTS**

### **4.1 Preliminary analysis**

The purpose of the preliminary analysis was to provide a good understanding of the measures of the variables. Among the participants as a whole there were clear differences between prevention- and promotion-focused responses to the risk frames. Table II shows two principal components, which were measured in a reliable way (Cronbach's alpha = .82 and .65). The situationally induced prevention-focused responses exhibited high

internal correlations between items on worry and flood preparedness, which may result from defensive pessimism. The promotion-focused component had high loadings for some items, but one of the items may not have been optimistic enough (i.e. “I would not think of high water levels as a problem that concerns me”) ; it received a much lower rating ( $M = 3.24$ ) than the others ( $M = 4.30$ ) and loaded less strongly on this component (.57).

#### TABLE II

The measures of chronic prevention and promotion orientations were also well described by two principal components. However, one of the items (“She has gotten into trouble at times, because of her not being careful enough”) received a much lower rating ( $M = 2.59$ ) than the others ( $M = 4.67$ ) and loaded weakly on both components (-.29 and .28). The wording of this item may have been too strong. Although theoretically meaningful, it was eliminated. The two components were measured in a reliable way (see Table III, Cronbach’s alpha = .74 and .61).

#### TABLE III

The principal component analysis used to check the measures of general and specific beliefs about climate change yielded two components, which were interpreted as skepticism about climate change and awareness of local climate impacts. Table IV shows the results. Optimism about sea level rise and agreement with the statement that the consequences of climate change have been exaggerated had positive loadings on the first

component and pessimism about sea level rise a negative loading. The item on pessimism had a small cross-loading (.32) on the second component, which emphasized the negative local consequences of climate change and flood risks outside the dikes. The two components were measured in a reliable way (Cronbach's alpha = .74 and .60) and correlated negatively ( $r = -.35, p < .001$ ).

TABLE IV

## 4.2 Main analysis

Table V gives an overview of the correlations between the variables used in the regression analysis. The hypothesized interaction was tested by a regression of the situationally induced prevention-focused responses on the experimental conditions (Model 1), the chronic motivational orientations and interaction terms (Model 2) and the other subject variables (Model 3). Table VI presents the unstandardized and standardized regression coefficients. There was a large difference in prevention-focused responses between the control group and the experimental groups ( $B = 1.49, p < .001$ ). In addition, the prevention-focused responses were somewhat higher among those who responded to the frames about living outside the dikes ( $B = .13, p < .001$ ), which also highlighted the risks ( $B = .05, p < .05$ ) instead of providing reassurance. Regression Model 2 shows that chronic prevention orientation was positively associated with the situationally induced prevention-focused responses but only among the experimental groups ( $B = .28, p < .001$ ). As a result of the interaction term  $R^2$  changed from .310 to .316 ( $p < .001$ ). Chronic promotion orientation did not make a noticeable difference in the regression results.



However, risk frame 3, which promoted waterside housing, had somewhat less impact ( $B = -.06, p < .05$ ) on prevention-focused responses. Finally, regression Model 3 shows that awareness of local climate impacts was slightly positively associated with the situationally induced prevention-focused responses ( $B = .12, p < .001$ ), unlike skepticism about climate change ( $B = -.03, p > .05$ ). Additionally, gender and age did not add to the prediction, but level of education made a small difference ( $B = .07, p < .01$ ). The overall model resulted in a  $R^2$  of .34.

TABLE V

TABLE VI

To further explore the role of promotion motivation in this context, we repeated the analysis presented in Table VI with situationally induced promotion-focused responses as dependent variable. The results (not presented here) indicated that there were only a few significant associations. There was no difference in promotion-focused responses between the control group and the experimental groups, except for the group who responded to frame 3, which promotes waterside living; they responded more promotion-focused than the others ( $B = .14, p < .001$ ). There were also positive associations with chronic promotion orientation ( $B = .30, p < .001$ ) and skepticism about climate change ( $B = .09, p < .001$ ). In this case, there was no significant interaction and the overall model resulted in a  $R^2$  of .14.

For the interpretation of these results, it is important to bear in mind that the study used a posttest-only control group design. The two potential moderating variables, chronic prevention and promotion orientation, were measured after the experimental part of the questionnaire. Under these circumstances, the experiment may have increased the participant's responsiveness to the measurement of the moderating variables. Indeed, the experimental conditions and the moderator were not orthogonal, as there was a slight positive association between the experimental groups and chronic prevention orientation ( $R^2 = .02$ ). This may have reduced the moderating effect of this variable. However, the effect was still substantial. Figure 2 depicts the interaction graphically, using values of the predictor variable (i.e. chronic prevention motivation) one standard deviation below and above the mean to generate two simple regression lines for control and experimental groups (see Ref. 48). Importantly, the two regression lines had different slopes and different intercepts. Although the difference in situationally induced prevention-focused responses between control and experimental groups was highest among participants with a high level of chronic prevention motivation, it was also large among the others.

FIGURE 2

## 5. DISCUSSION

The main contribution of this paper is the experimental validation of a new approach to flood risk communication that gives particular emphasis to the role of prevention motivation. This type of motivation, such as a desire to be careful about safety issues, may significantly affect people's reasoning and judgment about flood risks. Flood risk

communication framed in terms of prevention involves the notions of chance and harm, woven into a story about particular events that may necessitate decisions to be more careful about safety issues and protect one's family and oneself from danger. Hence, the risk frame is expected to stimulate people to anticipate the possibility of an unwelcome outcome of future events. The validity of the assumed process was tested in an empirical manner by looking for a significant interaction between people's chronic motivational orientation and the way the risk was framed. If people's reasoning about flood risk is influenced by prevention motivation, the risk frame will more likely have an effect on prevention-focused people than on others. Results indicated that the main hypothesis of the study was supported.

The interaction effect is not only important from a theoretical but also from a practical viewpoint. Although the difference between control and experimental groups was smallest for participants with a low level of chronic prevention motivation, it was large enough to be interesting for policy-makers. Hence, it is not necessary that policy-makers have to measure people's chronic dispositions before sending them risk communication messages. Additional differences between the risk frames were relatively small. This may be explained by the fact that all the information presented in the storylines (living outside the dikes or in a deep polder) and the communication strategies (highlight the risk, offer reassurance, promote waterside living) was based on realistic figures. These figures are far more relevant for policy-makers who want advice on communication issues than extreme probabilities or flood depths. Although small, the differences were meaningful from a theoretical point of view. Theoretically, any information that increases the "fit"

between a prevention-framed message and a person's chronic prevention motivation will produce stronger situationally induced, prevention-focused responses. This is in agreement with the data; the prevention-focused responses were somewhat higher among those who responded to the frames about living outside the dikes, which just highlighted the risks and did not offer reassurance. Hence, policy-makers who aim to improve communication about flood risks should consider how motivation works and how these insights can be used to frame their message in a coherent, prevention-oriented way.

Interestingly, chronic promotion motivation did not interfere with the prevention message. That is, goal-relevant aspects of the situation (i.e. the risk frames) affected also the momentary focus of individuals for whom a promotion focus is more accessible. In addition, the situation did elicit some promotion-focused responses. The participants' responses to frame 3, which provided risk information and also promoted waterside living, were slightly more promotion-focused and less prevention-focused than those to the other frames. The positive association between the promotion-focused responses to frame 3 and chronic promotion motivation is particularly interesting from the perspective of policy-makers who want to make the delta area more climate proof. Climate proofing may include the design of water city projects, featuring waterside living outside the embanked areas. The results indicated that the amenities of living near the water did appeal to promotion-focused people.

The issue of climate change seemed to have had a limited impact on the results. On the one hand, awareness of local climate impacts was slightly positively associated with the

situationally induced prevention-focused responses. On the other hand, skepticism about climate change (and optimism about its consequences) was slightly positively associated with the situationally induced promotion-focused responses. In view of these results, it should be mentioned that we did not communicate dire messages about the consequences of climate change, because these were expected to encounter resistance from some of the participants. To avoid any unnecessary resistance, climate change was not addressed in isolation but as part of an uncertain future.<sup>(49)</sup> Although we did not experimentally test this approach, the data suggest that it has worked out well. The participants were able to differentiate general beliefs about climate change from specific beliefs about climate change risks at the local level, and the latter were more relevant for flood risk communication.

Additional research is needed to specify more precisely the conditions under which flood-related prevention motivation increases. More elaborate models, such as PADM,<sup>(18)</sup> can be useful in this context. In addition, it is important to develop a motivational framework that encompasses more than fear reduction to include the role of socialization and mental strategies. RFT and other recent contributions (see Higgins, 2012)<sup>(13)</sup> offer a set of subtheories about motivational dynamics, which pay special attention to goal orientation (prevention or promotion), strategies to reach the goal (vigilant avoidance or eager approach), and goal-relevant aspects of the situation (risks or opportunities). Risk communication framed in terms of prevention should capture the events that may necessitate decisions to be more careful about safety issues and protect one's family and oneself from danger. Such decisions with a prevention orientation are qualitatively

different from other ones. If the value of the prevention goal increases, people may pessimistically believe that they will not succeed in obtaining security unless they carry out some specific activities now. This can explain, for instance, that previous flood experience contributes to the purchase of flood protection devices, such as protective barriers for windows and doors.<sup>(2)</sup> Motivation theory can also be very valuable for programs to increase the public's understanding of effective response.<sup>(50,51)</sup>

## **6. CONCLUSION**

Living in a river delta near the coast not only does provide the inhabitants with various amenities but is also linked to water nuisance and flood risks as a result of extreme weather events, which may increase with climate change. Climate proofing such a delta area will make use of hard infrastructure and also softer measures, such as evacuation plans, which require adequate communication with the inhabitants. In this context, the distinction between prevention and promotion motivation has far-reaching implications for our understanding of people's reasoning about risks. Flood risk communication framed in terms of prevention involves the notions of chance and harm, woven into a story about particular events that necessitate decisions to be more careful about safety issues and protect one's family and oneself from danger. The risk frames had a large effect on the participants, which was higher among chronic prevention-focused people than among others. Any information that increased the fit between a prevention-framed message and a person's chronic prevention motivation produced stronger situationally induced, prevention-focused responses. Although the difference between control and experimental groups was smallest for participants with a low level of chronic prevention

motivation, it was large enough to be interesting for policy-makers who aim to improve communication about risks. Flood risk communication might be hampered by skepticism about climate change, but probably less so if climate change is not addressed in isolation but as part of an uncertain future. Where climate proofing includes the design of water city projects, featuring waterside living outside the diked areas, it may particularly appeal to promotion-focused people.

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Table I

Research design: Focus of the storyline and communication strategy.

Focus	Communication strategy		
	Highlight the risk	Offer reassurance	Promote waterside living
<u>Experimental groups</u>			
Living outside the dikes	Frame 1 <i>n</i> = 423	Frame 2 <i>n</i> = 414	Frame 3 <i>n</i> = 415
Living in a deep polder	Frame 4 <i>n</i> = 433	Frame 5 <i>n</i> = 412	
<u>Control group</u>			
Living in one's own situation			<i>n</i> = 205

Table II

Situationally induced prevention- and promotion-focused responses: Mean (M), standard deviation (SD), and loadings after Varimax rotation.

Items	M	SD	Components	
			1	2
If I lived in a neighborhood outside the dikes then...				
/If I lived in a deep polder then...				
/As inhabitant of this river delta...				
... I would keep in mind that I will have to deal with flood damage sooner or later.	5.07	1.63	.85	.09
... I would make sure that I am well prepared for high water levels.	5.12	1.64	.83	.20
... I would fear that my property value will decrease because of concerns about high water levels.	4.19	1.77	.78	-.16
...I would become very agitated by images of high water levels.	4.16	1.82	.75	-.25
...I would mainly look at all the amenities of the water.	4.51	1.53	-.02	.85
...I think that my house will be very attractive because of the water abundant environment.	4.26	1.52	.19	.83
...I would not think of high water levels as a problem that concerns me.	3.28	1.66	-.21	.56
Eigenvalue			2.66	1.86

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Explained variance (%)	38.0	26.5
Cronbach's alpha	.82	.65

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Notes:  $n = 2,302$ . Scores: 1 = does not apply to me at all, 7 = applies to me completely.



Table III

Chronic prevention and promotion orientations: Mean (M), standard deviation (SD), and loadings after Varimax rotation.

Items (female version)	M	SD	Components	
			1	2
A safe environment is important for her; she prefers to avoid everything that is risky.	4.59	1.54	.80	-.06
She prefers to be insured; she feels uncomfortable about being without insurance.	5.16	1.47	.75	.15
Financial security is important for her; she prefers fixed energy prices and a fixed mortgage interest rate.	5.09	1.45	.72	.08
She has a healthy respect for the water; she feels that warnings of water-related hazards should be taken seriously.	5.33	1.37	.69	.24
She is able to handle setbacks very well; she remains optimistic about a positive outcome.	4.67	1.39	-.04	.68
She is drawn to the water; she feels that living near the water is attractive.	4.39	1.70	-.04	.67
Having a good place to live is important for her; especially a place with a view.	4.95	1.38	.31	.59
She is a fanatic when she is trying to reach her goal; it is important for her to be successful.	3.99	1.52	.15	.56

She enjoys the company of the people in her neighborhood; she becomes easily enthusiastic about doing something together.	3.90	1.56	.14	.55
Eigenvalue			2.32	1.98
Explained variance (%)			30.7	17.1
Cronbach's alpha			.74	.61

Notes:  $n = 2,302$ . Participants were asked to compare the portrait to themselves and to rate on a 7-point scale “how much like you” the person is. Scores: 1= not like me at all, 7= very much like me.

Table IV

Skepticism about the seriousness of climate change and awareness of local climate impacts: Mean (M), standard deviation (SD), and loadings after Promax rotation.

Items	M	SD	Components	
			1	2
I am optimistic and expect that sea level rise due to climate change will not be more than 10 centimeters during the next 20 years.	4.04	1.46	.93	.18
The seriousness of climate change has been exaggerated.	3.78	1.58	.81	.05
I am pessimistic and expect that sea level rise due to climate change will be more than 10 centimeters during the next 20 years.	3.78	1.50	-.63	.34
Due to climate change and flood risks, the value of the dwellings outside the dikes will decrease in the future.	4.40	1.30	.05	.79
Because of climate change harbor areas outside the dikes will be flooded more frequently and at greater depth.	4.41	1.24	-.17	.72
By improving spatial planning in cities like Rotterdam and Dordrecht, they can counter the impacts of climate change.	4.09	1.41	.19	.72
Eigenvalue			2.17	2.02
Explained variance (%)			41.7	21.0
Cronbach's alpha			.74	.60

Notes:  $n = 2,302$ . Scores: 1 = completely disagree, 7= completely agree.

Table V

Overview of the variables: Mean (M), standard deviation (SD) and correlations.

	M	SD	1	2	3	4	5	6	7	8
1. Situationally induced prevention	.00	1.00	—							
2. Situationally induced promotion	.00	1.00	.00	—						
3. Chronic prevention	.00	1.00	.39***	-.11***	—					
4. Chronic promotion	.00	1.00	-.03	.31***	.00	—				
5. Skepticism about climate change	.00	1.00	-.15***	.15***	-.14***	.12***	—			
6. Awareness of local climate impacts	.00	1.00	.26***	-.08***	.33***	.09***	-.35***	—		
7. Gender (1 male, 2 woman)	1.49	.50	.04	-.06**	.06**	-.03	-.03	.00	—	
8. Age category	2.24	.69	.02	.01	.17***	.01	.08***	.07**	-.10***	—
9. Level of education	2.20	.90	.02	.02	-.16***	.04	-.06**	.00	-.02	-.30***

\*\*\*  $p < .01$ ; \*\*  $p < .001$

Notes: n= 2,302.

Table VI

Regression of the situationally induced prevention-focused responses on experimental conditions and subject variables:

Unstandardized coefficient (B), standard error (SE), and standardized coefficient (Beta).

	Model								
	1			2			3		
	<i>B</i>	<i>SE</i>	<i>Beta</i>	<i>B</i>	<i>SE</i>	<i>Beta</i>	<i>B</i>	<i>SE</i>	<i>Beta</i>
(Constant)	-1.39***	(.06)		-1.36***	(.06)		-1.50***	(.06)	
<u>Experimental conditions</u>									
Control vs. experimental groups	1.49***	(.07)	.42	1.42***	(.07)	.41	1.42***	(.07)	.40
(control = 0, frames 1 to 5 = 1)									
Inside vs. outside the dikes	.13***	(.02)	.12	.12***	(.02)	.11	.11***	(.02)	.10
(frames 4, 5 = -1, frames 1, 2 = 1)									
Reassurance vs. risk	.05*	(.02)	.05	.04*	(.02)	.04	.04	(.02)	.03
(frames 2, 5 = -1, frames 1, 4 = 1)									
Risk/reassurance vs. promote waterside	-.04	(.03)	-.03	-.06*	(.03)	-.05	-.06*	(.03)	-.04
(frames 1, 2, 4, 5 = -1, frame 3 = 1)									
<u>Subject variables</u>									

Chronic prevention	.08	(.06)	.08	.05	(.06)	.05
Chronic prevention x Experimental groups	.28***	(.06)	.26	.27***	(.06)	.26
Chronic promotion	.01	(.05)	.01	.00	(.05)	.00
Chronic promotion x Experimental groups	-.04	(.06)	-.04	-.03	(.06)	-.03
Skepticism about climate change				-.03	(.02)	-.03
Awareness of local climate impacts				.12***	(.02)	.12
Gender (1 male, 2 woman)				.06	(.03)	.03
Age category				-.04	(.03)	-.03
Level of education				.07**	(.02)	.06
R square	.20		.32	.34		

\*  $p < .05$ ; \*\*  $p < .01$ ; \*\*\*  $p < .001$

Notes:  $n = 2,302$ . The experimental conditions were dummy coded to test for the effects of the frames. The first dummy variable represents the difference between control and experimental groups; the other dummy variables represent additional differences between those who responded to the frames about living inside or outside the dikes, the frames that provided reassurance or highlighted the risk, and the frames that either or not promoted waterside housing.

Figure 1

Research model

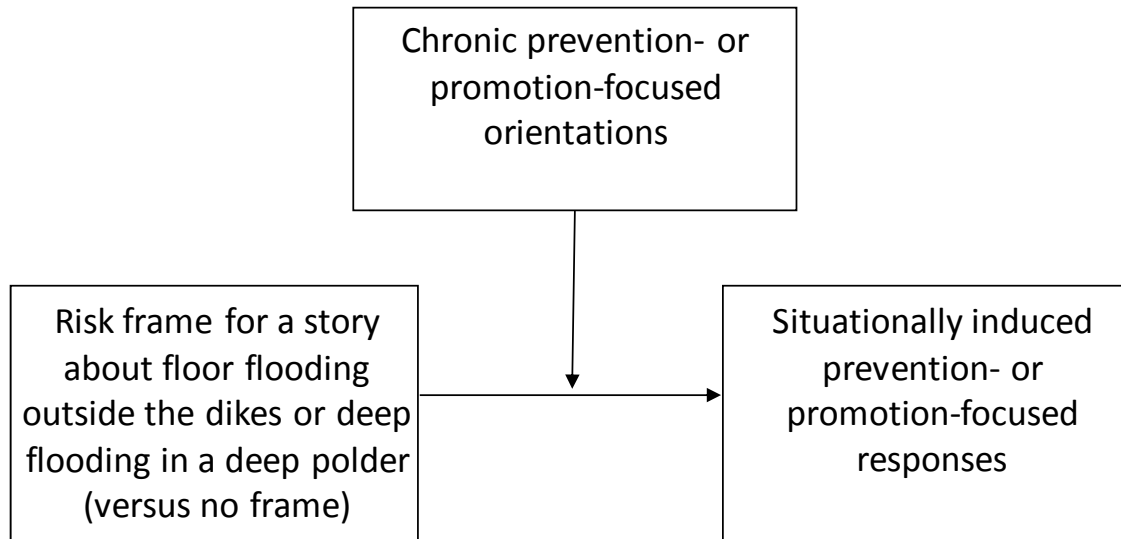




Figure 2

Graph of the interaction effect

